

DEVICE FOR DETERMINING THE POSITION OR SIZE OF A HOLE

5 BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to a device for determining the position of or for measuring a hole, and to an attachment element.

10 In numerous technical applications it is necessary, in order to measure a component, to determine the precise positions of or distances between a number of holes formed in the component. For example, in the sphere of using measuring techniques to check body shells and
15 also subgroups thereof, for example sheet-metal add-on parts or else individual parts, measurements of this type have to be carried out frequently. A difficulty here is that the holes or the central points thereof are not accessible directly and so precise measurements turn out
20 to be very complicated. Furthermore, the dimensions of holes are frequently affected by tolerances and so it is expedient to determine the central points of holes.

DE-C 936895 discloses a device for measuring distances on an object, which device is inserted into a
25 hole in the object to be measured. The device consists of two separate parts, namely a shank for fitting into the hole in the object, and a part which ends in a ball of a certain radius of curvature. This ball can be positioned in such a manner that it serves as reference point with
30 respect to the central point of the hole. A disadvantage of this device is that it is not possible to use this device to undertake a measurement at inaccessible locations, for example on a floor panel of a motor vehicle body, since the device does not have any means
35 for fixing it so as to undertake precise measurements in the hole to be measured.

DE-C 733 370 discloses a means for measuring distances of connecting points, in particular points which cannot be measured directly, such as ball centres,
40 the said means consisting of a main measuring rod having longitudinally adjustable sliding bodies and measuring elements which can be displaced therein transversely to the main measuring rod. This means which is of

comparatively large construction is not suitable for undertaking measurements at inaccessible locations.

German utility model G 91 06 101 discloses a precision measuring rod which, by inserting a spike into an opening, permits the diameter of the opening to be measured. The precise determination of the position of the opening is not the subject matter of the teaching described in this publication.

The object of the invention is the provision of a device with which a determination of the position of or measurement of inaccessible holes or recesses in a component is possible in a simple manner.

The invention provides a device with which the precise determination of the position of holes or recesses, for example in a body of a motor vehicle, can be carried out in a simple manner. The formation of at least part of the attachment element from a magnetic material enables the device according to the invention to be simply and reliably fixed on a component, which facilitates the carrying-out of very precise measurements. Measurements can also be carried out without any problem at inaccessible locations, for example the floor panel of a motor vehicle body, since the device according to the invention can be inserted, for example from below, into a hole in the floor panel and can be fixed in the inserted position without further auxiliary means. The device according to the invention can be produced very reasonably. A particular advantage is the mounting of at least one attachment element together with a multiplicity of spikes in a jig. In this case, all of the spikes required for measuring a body together with an attachment element which can be used with all of the spikes can be provided in an easily surveyed manner.

Of course, protection is sought for the attachment element which can be used in such a manner like an adapter and into which spikes of any design can be inserted.

According to a preferred refinement of the device according to the invention, the attachment element has an essentially hemispherical or partially spherical shell made of a non-magnetic material, and an insert arranged within the shell and made of a magnetic material. At the

insert use can be made, for example, of a conventional magnetic flat gripper which can be fixed in a simple and positionally precise manner in a shell made, for example, of aluminium.

5 The spike can expediently be screwed to the attachment element. This firstly makes precise positioning of the spike in the attachment element possible, but secondly also enables the two parts to be detached from one another in an uncomplicated manner, 10 with the result that one attachment element can be used for a multiplicity of spikes.

 According to a preferred refinement of the device according to the invention, the spike has an upper part which is designed with a screw thread, can be passed 15 through the insert and can be screwed to the inside of the shell. This enables the insert to first of all be positioned and/or fixed in a precisely fitting manner in the shell, as a result of which the attachment part composed in such a manner can be used in an adapter-like 20 manner together with a multiplicity of spikes.

 According to a further preferred refinement of the device according to the invention, the spike can be fastened to the attachment element in an asymmetrical manner with respect thereto. This can take place, for 25 example, by milling off a circular-section-like part of the hemispherical shell and of the corresponding part of the insert. This enables the device according to the invention to be used in the direct vicinity of a chamfer or of a radius.

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BRIEF DESCRIPTION OF THE DRAWINGS

 A preferred embodiment of the invention is described in detail with reference to the attached 35 drawing, in which:

Fig. 1 shows an exploded, lateral sectional view of a preferred embodiment of the device according to the invention,

40 Fig. 2 shows a lateral sectional view of the device according to Fig. 1 in the assembled state, and

Fig. 3 shows a lateral sectional view of a further embodiment of the device according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 illustrates the individual components of the device according to the invention in detail, and Fig. 2 illustrates them in the assembled state.

A spike 1 can be passed by means of its upper part 1a, which is designed with a screw thread, through a central passage in an insert 4 of an attachment element 2 and can be screwed to an internal thread 13 provided on the inside of an outer shell 3 of the attachment element 2. The insert 4 can be arranged and fixed in this case in a precisely fitting manner in the shell 3, as can be seen in particular in Fig. 2. In this case, the lower edge 3a of the shell 3 bears flush against the lower side 4a of the insert 4. The edge 3a which is of bevelled or chamfered design ensures that the attachment element 2 can be positioned in a simple manner or can be removed from a component surface by hand.

The spike 1 is customarily manufactured from a metallic material. The shell 3 is produced from a non-magnetic material, for example aluminium, and the insert 4 from a magnetic material. It would be conceivable also to produce the shell 3 from a magnetic material. Furthermore, the components 3, 4 could be designed as a single piece.

On account of the magnetic properties of the insert 4, the attachment element 2 can be fastened in a simple and secure manner to a body part, for example to a floor panel 5, as illustrated in Fig. 3. In this case, the spike 1 which is arranged in the attachment element 2 is inserted into a hole formed in the floor panel 5, so that the lower side 4a of the insert can rest flat on the floor panel 5. Magnetic forces between the insert 4 and floor panel 5 ensure that the attachment element 2 can also be fastened to the lower side of the floor panel 5 in a simple manner, as illustrated.

A partially spherical surface or hemispherical surface as is provided by the surface of the shell 3, can be measured in a simple manner which is known per se (customarily using 5 scanning procedures), so that the central point of hole, into which the spike 1 which is in operative connection with the shell 3 is inserted, can be

determined. By virtue of the fact that one attachment element 2 can be used in an adapter-like manner for a multiplicity of spikes 1, the measuring and adjustment outlay for measuring, for example, a body which has holes of differing size into which different spikes 1 in each case have to be inserted, is substantially reduced. The use of the device according to the invention means that it is no longer necessary to measure and to report on a multiplicity of different attachment elements.

Fig. 3 additionally illustrates how, in accordance with a particular refinement of the attachment element 2, measurement of holes to which access is difficult in the vicinity of an edge 5a is possible. By milling of a circular-section-shaped part of the attachment element 2, positioning of a hole formed in the direct vicinity of the edge 5a is possible in a simple manner. Since a sufficiently large spherical surface is, as before, provided by the shell 3, measuring or determining the position of the hole in which the spike 1 is positioned can also be carried out here.

When the device according to the invention is used, a hole which is to be measured can readily be removed up to approximately 5 mm from its desired position without necessitating an interruption because of a collision to a CNC series measuring sequence during the measuring of the attachment element. The method for measuring a spherical surface is always identical, so that the surface and/or the characteristic data of the attachment element 2 can always be reflected (reused) in the programming, thereby rendering repeated measurement of the spherical surface superfluous.

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[Stuttgart]

5 [Device for determining the position of or for measuring
a hole] DEVICE FOR DETERMINING THE POSITION OR SIZE OF A
HOLE

BACKGROUND AND SUMMARY OF THE INVENTION

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The present invention relates to a device for determining the position of or for measuring a hole [in accordance with the preamble of Patent Claim 1], and to an attachment element [in accordance with the preamble of Patent Claim 6].

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In numerous technical applications it is necessary, in order to measure a component, to determine the precise positions of or distances between a number of holes formed in the component. For example, in the sphere of using measuring techniques to check body shells and also subgroups thereof, for example sheet-metal add-on parts or else individual parts, measurements of this type have to be carried out frequently. A difficulty here is that the holes or the central points thereof are not accessible directly and so precise measurements turn out to be very complicated. Furthermore, the dimensions of holes are frequently affected by tolerances and so it is expedient to determine the central points of holes.

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DE-C 936895 discloses a device for measuring distances on an object, which device is inserted into a hole in the object to be measured. The device consists of two separate parts, namely a shank for fitting into the hole in the object, and a part which ends in a ball of a certain radius of curvature. This ball can be positioned in such a manner that it serves as reference point with respect to the central point of the hole. A disadvantage of this device is that it is not possible to use this device to undertake a measurement at inaccessible locations, for example on a floor panel of a motor vehicle body, since the device does not have any means for fixing it so as to undertake precise measurements in the hole to be measured.

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DE-C 733 370 discloses a means for measuring distances of connecting points, in particular points which cannot be measured directly, such as ball centres, the said means consisting of a main measuring rod having
5 longitudinally adjustable sliding bodies and measuring elements which can be displaced therein transversely to the main measuring rod. This means which is of comparatively large construction is not suitable for undertaking measurements at inaccessible locations.

10 German utility model G 91 06 101 discloses a precision measuring rod which, by inserting a spike into an opening, permits the diameter of the opening to be measured. The precise determination of the position of the opening is not the subject matter of the teaching
15 described in this publication.

The object of the invention is the provision of a device with which a determination of the position of or measurement of inaccessible holes or recesses in a component is possible in a simple manner.

20 [This object is achieved by means of a device having the features of Patent Claim 1 and also by means of an attachment element having the features of Patent Claim 6.]

The invention provides a device with which the
25 precise determination of the position of holes or recesses, for example in a body of a motor vehicle, can be carried out in a simple manner. The formation of at least part of the attachment element from a magnetic material enables the device according to the invention to
30 be simply and reliably fixed on a component, which facilitates the carrying-out of very precise measurements. Measurements can also be carried out without any problem at inaccessible locations, for example the floor panel of a motor vehicle body, since
35 the device according to the invention can be inserted, for example from below, into a hole in the floor panel and can be fixed in the inserted position without further auxiliary means. The device according to the invention can be produced very reasonably. A particular advantage
40 is the mounting of at least one attachment element together with a multiplicity of spikes in a jig. In this case, all of the spikes required for measuring a body

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together with an attachment element which can be used with all of the spikes can be provided in an easily surveyed manner.

Of course, protection is sought for the attachment element which can be used in such a manner like an adapter and into which spikes of any design can be inserted.

[Advantageous refinements of the invention are the subject matter of the subclaims.]

According to a preferred refinement of the device according to the invention, the attachment element has an essentially hemispherical or partially spherical shell made of a non-magnetic material, and an insert arranged within the shell and made of a magnetic material. At the insert use can be made, for example, of a conventional magnetic flat gripper which can be fixed in a simple and positionally precise manner in a shell made, for example, of aluminium.

The spike can expediently be screwed to the attachment element. This firstly makes precise positioning of the spike in the attachment element possible, but secondly also enables the two parts to be detached from one another in an uncomplicated manner, with the result that one attachment element can be used for a multiplicity of spikes.

According to a preferred refinement of the device according to the invention, the spike has an upper part which is designed with a screw thread, can be passed through the insert and can be screwed to the inside of the shell. This enables the insert to first of all be positioned and/or fixed in a precisely fitting manner in the shell, as a result of which the attachment part composed in such a manner can be used in an adapter-like manner together with a multiplicity of spikes.

According to a further preferred refinement of the device according to the invention, the spike can be fastened to the attachment element in an asymmetrical manner with respect thereto. This can take place, for example, by milling off a circular-section-like part of the hemispherical shell and of the corresponding part of the insert. This enables the device according to the

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invention to be used in the direct vicinity of a chamfer or of a radius.

BRIEF DESCRIPTION OF THE DRAWINGS

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A preferred embodiment of the invention is described in detail with reference to the attached drawing, in which:

10 Fig. 1 shows an exploded, lateral sectional view of a preferred embodiment of the device according to the invention,

Fig. 2 shows a lateral sectional view of the device according to Fig. 1 in the assembled state, and

15 Fig. 3 shows a lateral sectional view of a further embodiment of the device according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

20 Fig. 1 illustrates the individual components of the device according to the invention in detail, and Fig. 2 illustrates them in the assembled state.

25 A spike 1 can be passed by means of its upper part 1a, which is designed with a screw thread, through a central passage in an insert 4 of an attachment element 2 and can be screwed to an internal thread 13 provided on the inside of an outer shell 3 of the attachment element 2. The insert 4 can be arranged and fixed in this case in a precisely fitting manner in the shell 3, as can be seen
30 in particular in Fig. 2. In this case, the lower edge 3a of the shell 3 bears flush against the lower side 4a of the insert 4. The edge 3a which is of bevelled or chamfered design ensures that the attachment element 2 can be positioned in a simple manner or can be removed
35 from a component surface by hand.

The spike 1 is customarily manufactured from a metallic material. The shell 3 is produced from a non-magnetic material, for example aluminium, and the insert 4 from a magnetic material. It would be
40 conceivable also to produce the shell 3 from a magnetic material. Furthermore, the components 3, 4 could be designed as a single piece.

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On account of the magnetic properties of the insert 4, the attachment element 2 can be fastened in a simple and secure manner to a body part, for example to a floor panel 5, as illustrated in Fig. 3. In this case, the spike 1 which is arranged in the attachment element 2 is inserted into a hole formed in the floor panel 5, so that the lower side 4a of the insert can rest flat on the floor panel 5. Magnetic forces between the insert 4 and floor panel 5 ensure that the attachment element 2 can also be fastened to the lower side of the floor panel 5 in a simple manner, as illustrated.

A partially spherical surface or hemispherical surface as is provided by the surface of the shell 3, can be measured in a simple manner which is known per se (customarily using 5 scanning procedures), so that the central point of hole, into which the spike 1 which is in operative connection with the shell 3 is inserted, can be determined. By virtue of the fact that one attachment element 2 can be used in an adapter-like manner for a multiplicity of spikes 1, the measuring and adjustment outlay for measuring, for example, a body which has holes of differing size into which different spikes 1 in each case have to be inserted, is substantially reduced. The use of the device according to the invention means that it is no longer necessary to measure and to report on a multiplicity of different attachment elements.

Fig. 3 additionally illustrates how, in accordance with a particular refinement of the attachment element 2, measurement of holes to which access is difficult in the vicinity of an edge 5a is possible. By milling of a circular-section-shaped part of the attachment element 2, positioning of a hole formed in the direct vicinity of the edge 5a is possible in a simple manner. Since a sufficiently large spherical surface is, as before, provided by the shell 3, measuring or determining the position of the hole in which the spike 1 is positioned can also be carried out here.

When the device according to the invention is used, a hole which is to be measured can readily be removed up to approximately 5 mm from its desired position without necessitating an interruption because of a collision to a CNC series measuring sequence during the

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measuring of the attachment element. The method for measuring a spherical surface is always identical, so that the surface and/or the characteristic data of the attachment element 2 can always be reflected (reused) in
5 the programming, thereby rendering repeated measurement of the spherical surface superfluous.

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Device for determining the position of or for measuring
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accordance with the preamble of Patent Claim 1, and to
an attachment element in accordance with the preamble
of Patent Claim 6.

15 In numerous technical applications it is
necessary, in order to measure a component, to
determine the precise positions of or distances between
a number of holes formed in the component. For example,
in the sphere of using measuring techniques to check
body shells and also subgroups thereof, for example
20 sheet-metal add-on parts or else individual parts,
measurements of this type have to be carried out
frequently. A difficulty here is that the holes or the
central points thereof are not accessible directly and
so precise measurements turn out to be very
25 complicated. Furthermore, the dimensions of holes are
frequently affected by tolerances and so it is
expedient to determine the central points of holes.

DE-C 936895 discloses a device for measuring
distances on an object, which device is inserted into a
30 hole in the object to be measured. The device consists
of two separate parts, namely a shank for fitting into
the hole in the object, and a part which ends in a ball
of a certain radius of curvature. This ball can be
positioned in such a manner that it serves as reference
35 point with respect to the central point of the hole. A
disadvantage of this device is that it is not possible
to use this device to undertake a measurement at
inaccessible locations, for example on a floor panel of

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a motor vehicle body, since the device does not have any means for fixing it so as to undertake precise measurements in the hole to be measured.

DE-C 733 370 discloses a means for measuring
5 distances of connecting points, in particular points which cannot be measured directly, such as ball centres, the said means consisting of a main measuring rod having longitudinally adjustable sliding bodies and measuring elements which can be displaced therein
10 transversely to the main measuring rod. This means which is of comparatively large construction is not suitable for undertaking measurements at inaccessible locations.

German utility model G 91 06 101 discloses a
15 precision measuring rod which, by inserting a spike into an opening, permits the diameter of the opening to be measured. The precise determination of the position of the opening is not the subject matter of the teaching described in this publication.

20 The object of the invention is the provision of a device with which a determination of the position of or measurement of inaccessible holes or recesses in a component is possible in a simple manner.

This object is achieved by means of a device
25 having the features of Patent Claim 1 and also by means of an attachment element having the features of Patent Claim 6.

The invention provides a device with which the precise determination of the position of holes or
30 recesses, for example in a body of a motor vehicle, can be carried out in a simple manner. The formation of at least part of the attachment element from a magnetic material enables the device according to the invention to be simply and reliably fixed on a component, which
35 facilitates the carrying-out of very precise measurements. Measurements can also be carried out without any problem at inaccessible locations, for example the floor panel of a motor vehicle body, since the device according to the invention can be inserted,

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for example from below, into a hole in the floor panel and can be fixed in the inserted position without further auxiliary means. The device according to the invention can be produced very reasonably. A particular
5 advantage is the mounting of at least one attachment element together with a multiplicity of spikes in a jig. In this case, all of the spikes required for measuring a body together with an attachment element which can be used with all of the spikes can be
10 provided in an easily surveyed manner.

Of course, protection is sought for the attachment element which can be used in such a manner like an adapter and into which spikes of any design can be inserted.

15 Advantageous refinements of the invention are the subject matter of the subclaims.

According to a preferred refinement of the device according to the invention, the attachment element has an essentially hemispherical or partially
20 spherical shell made of a non-magnetic material, and an insert arranged within the shell and made of a magnetic material. At the insert use can be made, for example, of a conventional magnetic flat gripper which can be fixed in a simple and positionally precise manner in a
25 shell made, for example, of aluminium.

The spike can expediently be screwed to the attachment element. This firstly makes precise positioning of the spike in the attachment element possible, but secondly also enables the two parts to be
30 detached from one another in an uncomplicated manner, with the result that one attachment element can be used for a multiplicity of spikes.

According to a preferred refinement of the device according to the invention, the spike has an
35 upper part which is designed with a screw thread, can be passed through the insert and can be screwed to the inside of the shell. This enables the insert to first of all be positioned and/or fixed in a precisely fitting manner in the shell, as a result of which the

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attachment part composed in such a manner can be used in an adapter-like manner together with a multiplicity of spikes.

According to a further preferred refinement of the device according to the invention, the spike can be fastened to the attachment element in an asymmetrical manner with respect thereto. This can take place, for example, by milling off a circular-section-like part of the hemispherical shell and of the corresponding part of the insert. This enables the device according to the invention to be used in the direct vicinity of a chamfer or of a radius.

A preferred embodiment of the invention is described in detail with reference to the attached drawing, in which:

Fig. 1 shows an exploded, lateral sectional view of a preferred embodiment of the device according to the invention,

Fig. 2 shows a lateral sectional view of the device according to Fig. 1 in the assembled state, and

Fig. 3 shows a lateral sectional view of a further embodiment of the device according to the invention.

Fig. 1 illustrates the individual components of the device according to the invention in detail, and Fig. 2 illustrates them in the assembled state.

A spike 1 can be passed by means of its upper part 1a, which is designed with a screw thread, through a central passage in an insert 4 of an attachment element 2 and can be screwed to an internal thread 13 provided on the inside of an outer shell 3 of the attachment element 2. The insert 4 can be arranged and fixed in this case in a precisely fitting manner in the shell 3, as can be seen in particular in Fig. 2. In this case, the lower edge 3a of the shell 3 bears flush against the lower side 4a of the insert 4. The edge 3a which is of bevelled or chamfered design ensures that the attachment element 2 can be positioned in a simple manner or can be removed from a component surface by

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hand.

The spike 1 is customarily manufactured from a metallic material. The shell 3 is produced from a non-magnetic material, for example aluminium, and the insert 4 from a magnetic material. It would be conceivable also to produce the shell 3 from a magnetic material. Furthermore, the components 3, 4 could be designed as a single piece.

On account of the magnetic properties of the insert 4, the attachment element 2 can be fastened in a simple and secure manner to a body part, for example to a floor panel 5, as illustrated in Fig. 3. In this case, the spike 1 which is arranged in the attachment element 2 is inserted into a hole formed in the floor panel 5, so that the lower side 4a of the insert can rest flat on the floor panel 5. Magnetic forces between the insert 4 and floor panel 5 ensure that the attachment element 2 can also be fastened to the lower side of the floor panel 5 in a simple manner, as illustrated.

A partially spherical surface or hemispherical surface as is provided by the surface of the shell 3, can be measured in a simple manner which is known per se (customarily using 5 scanning procedures), so that the central point of hole, into which the spike 1 which is in operative connection with the shell 3 is inserted, can be determined. By virtue of the fact that one attachment element 2 can be used in an adapter-like manner for a multiplicity of spikes 1, the measuring and adjustment outlay for measuring, for example, a body which has holes of differing size into which different spikes 1 in each case have to be inserted, is substantially reduced. The use of the device according to the invention means that it is no longer necessary to measure and to report on a multiplicity of different attachment elements.

Fig. 3 additionally illustrates how, in accordance with a particular refinement of the attachment element 2, measurement of holes to which

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access is difficult in the vicinity of an edge 5a is possible. By milling of a circular-section-shaped part of the attachment element 2, positioning of a hole formed in the direct vicinity of the edge 5a is possible in a simple manner. Since a sufficiently large spherical surface is, as before, provided by the shell 3, measuring or determining the position of the hole in which the spike 1 is positioned can also be carried out here.

When the device according to the invention is used, a hole which is to be measured can readily be removed up to approximately 5 mm from its desired position without necessitating an interruption because of a collision to a CNC series measuring sequence during the measuring of the attachment element. The method for measuring a spherical surface is always identical, so that the surface and/or the characteristic data of the attachment element 2 can always be reflected (reused) in the programming, thereby rendering repeated measurement of the spherical surface superfluous.

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